

CLAIMS

1. A substrate processing apparatus comprising:
 - a steam generator having a tank and at least one heater, and adapted to generate steam by heating deionized water contained in the tank to vaporize the deionized water with the heater; and
 - a processing vessel adapted to process therein a substrate with steam generated by the steam generator,wherein:
 - the tank includes a hollow, tubular body arranged with the axis thereof extending horizontally and having opposite open ends, and a pair of plate members covering the opposite open ends of the tubular body to define an interior space of the tank together with the tubular body;
 - the tubular body is formed of a resin material; and
 - said at least one heater is disposed outside the interior space of the tank while contacting with or arranged adjacent to an outer surface of at least one of the plate members.
2. The substrate processing apparatus according to claim 1, wherein the resin material forming the tubular body is a composite of PTEF and PFA .
3. The substrate processing apparatus according to claim 1, wherein the plate member contacting with or arranged adjacent to the heater is formed of a material having a thermal conductivity higher than that of the resin material forming the tubular body.
4. The substrate processing apparatus according to claim 3, wherein the plate member contacting with or arranged adjacent to the heater is formed of a metal, and has a surface provided thereon with a coating layer of a resin material.
5. The substrate processing apparatus according to claim 1,

further comprising a shell surrounding the tank to restrict deformation of the tank due to an internal pressure of the tank, wherein the heater is mounted to the shell at a position adjacent to the plate member.

6. The substrate processing apparatus according to claim 1, wherein:

the pair of plate members are formed of a material having a thermal conductivity higher than that of the resin material forming the tubular body;

two heaters are provided as said at least one heater;

the two heaters are disposed outside the interior space of the tank while contacting with or arranged adjacent to outer surfaces of the pair of plate members.

7. The substrate processing apparatus according to claim 6, wherein the pair of the plate members are formed of a metallic material, and surfaces of the plate members are provided thereon with coating layers of a resin material.

8. The substrate processing apparatus according to claim 1, wherein:

the heater includes a heat transfer block and a heating element provided at the heat transfer block;

an upper edge of the heat transfer block is located at a level substantially corresponding to a set level of deionized water contained in the tank; and

the heating element is placed in a lower part of the heat transfer block.

9. The substrate processing apparatus according to claim 1, wherein:

a deionized water supply line for supplying deionized water into the tank, a drain line for draining deionized water from the tank and a steam discharge line for discharging steam from the tank penetrate the tubular body;

the deionized water supply line opens into the tank at a position below a set level of deionized water in the tank,

the drain line opens into the tank at a position below the set level of deionized water in the tank, and

the steam discharge line opens into the tank at a position above the set level of deionized water in the tank.

10. The substrate processing apparatus according to claim 1, wherein:

the tank is provided with a steam outlet port through which steam generated in the tank is sent out toward the processing vessel, and

at least one baffle plate is placed in the tank to prevent the mist of deionized water from reaching the steam outlet port.

11. The substrate processing apparatus according to claim 10, wherein:

a plurality of baffle plates, as said at least one baffle plate, are vertically arranged; and

each of the baffle plates has at least one opening permitting steam to flow therethrough; the opening of an upper one of the two adjacent vertically arranged baffle plates does not overlap the opening of a lower one.

12. The substrate processing apparatus according to claim 1, further comprising a shell surrounding the tank to restrict deformation of the tank due to internal pressure of the tank,

wherein:

elastic sealing members are held between the tubular body of the tank and the plate members, respectively; and

the tank and the shell are configured such that the shell presses the plate members against the tubular body and the elastic sealing members are compressed to seal gaps between the tubular body and the plate members in an airtight and liquid-tight fashion when the tank is placed in the shell.

13. The substrate processing apparatus according to claim 12, wherein the tank and the shell are sized so that the plate members may not be in direct contact with the tubular body when the tank is placed in the shell and component members of the tank are joined in an airtight and liquid-tight fashion.

14. The substrate processing apparatus according to claim 1, wherein an interior space of the tank has a shape of a cylinder in general having a horizontal center axis.

15. The substrate processing apparatus according to claim 14, wherein the cylinder is sized such that a bottom of the cylinder corresponding to a side of the tank has a diameter greater than a height of the cylinder corresponding to a horizontal width of the tank.

16. The substrate processing apparatus according to claim 1, further comprising an ozone generator adapted to generate ozone gas, wherein a mixed process fluid containing steam generated by the steam generator and ozone gas generated by the ozone generator is supplied into the processing vessel to process a substrate held in the processing vessel.